ABSTRACT

of the

DRAFT

ENVIRONMENTAL IMPACT

STATEMENT

Proposed Foothills Project

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
COLORADO STATE OFFICE

Feb. 1976

This abstract contains copies of selected pages from the complete text of the Draft Environmental Impact Statement on the Proposed Foothills Project. It is believed these pages contain the essence of the Draft EIS and include those items which are considered most significant. For example, metropolitan growth impacts (there are none predicted as a result of this proposal), impacts on surface water, and the relationship of this proposal to the Bureau of Reclamation's Upper South Platte Unit ("Two Forks"). Other material necessary for an overall understanding of the total project is included in summary form. No attempt is made here to generate new material or develop analysis in addition to or different from what is contained in the Draft. The complete Table of Contents from the Draft is included. All other items contained in the abstract are noted by an asterisk in the Table of Contents.

Copies of the complete draft environmental statement may be obtained by writing the Office of Public Affairs, Bureau of Land Management, Room 700, Colorado State Bank Building, 1600 Broadway, Denver, Colorado 80202.

SUMMARY

(X) Draft ( ) Final Environmental Statement

Department of the Interior, Bureau of Land Management

1. Type of Action: (X) Administrative ( ) Legislative

2. Brief Description of Action: The Board of Water Commissioners for the City and County of Denver propose to construct, operate and maintain water-diversion facilities on federally managed lands on the South Platte River 25 miles southwest of Denver, Colorado as a part of the proposed Foothills Project. The project would also include a 125 million gallon per day water treatment plant and distribution conduit system extending into the Denver metropolitan area. Sources of water would include both the South Platte River and the Blue River via Dillon Reservoir and the Harold D. Roberts Tunnel.

3. Summary of Environmental Impacts:

The proposed action would result in the consumption of reliably available water supplies by 1988 rather than 1995 without the project. Other impacts would include the loss of 1.7 miles of free-flowing river, 1,752.6 additional tons of sediments, 50 Bighorn sheep, most of the historic narrow gage railroad features and about 15,000 recreation visits to the South Platte Canyon.

4. Alternatives Considered:

A. No Action. (Rejection of the Application)

B. Major Alternatives

1. Chatfield Alternative
2. Upstream Dam

C. Minor Alternatives

1. Lower Dam
2. Dam Intake Structure
3. Elevator Access to the Dam Crest
4. Alternate Road
5. Underground Power and Telephone Lines
6. Eight-foot Diameter Tunnel

5. Date Statement Made Available to CEQ and the Public:

Draft Statement:

Final Statement:

6. Comments Will Be Requested from the Following:

Department of Agriculture
- Forest Service
- Soil Conservation Service

Department of Commerce
- National Bureau of Standards

Department of Defense
- Corps of Engineers

Environmental Protection Agency

Department of the Interior
- U.S. Fish and Wildlife Service
- Bureau of Reclamation
- Bureau of Outdoor Recreation
- Office of Land Use and Water Planning
- U.S. Geological Survey
- Bureau of Mines
- National Park Service

Department of Health, Education and Welfare

Department of Transportation

Water Resources Council

River Basin Commission
- Upper Colorado
- Missouri River

Department of Housing and Urban Development

Federal Power Commission

Advisory Council on Historic Preservation

State Clearinghouses
- State of Arizona
- State of California
- State of Colorado
- State of Utah

Colorado Open Space Council

Institute of Ecology

League of Women Voters

National Resources Defense Council

Trout Unlimited

Sierra Club

Table of Contents

CHAPTER I

DESCRIPTION OF THE PROPOSED ACTION

CHAPTER II

DESCRIPTION OF THE ENVIRONMENT

Table of Contents

Table of Contents

CHAPTER III

ENVIRONMENTAL IMPACTS OF THE PROPOSAL

Table of Contents

CHAPTER IV

MITIGATING MEASURES

CHAPTER V

* ADVERSE IMPACTS THAT CANNOT BE AVOIDED
(INTRODUCTION ONLY)

Table of Contents

CHAPTER VI

*THE RELATIONSHIP BETWEEN LOCAL SHORT TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG TERM PRODUCTIVITY

CHAPTER VII

* IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

CHAPTER VIII

ALTERNATIVES TO THE PROPOSED ACTION

Table of Contents

CHAPTER IX

CONSULTATION AND COORDINATION WITH OTHERS

List of Figures

List of Figures

List of Figures

List of Tables

List of Tables

List of Tables

List of Tables

Appendices

I. DESCRIPTION OF THE PROPOSED ACTION

Introduction

Summary

The Board of Water Commissioners for the City and County of Denver (Denver Water Board--DWB) has applied to the Bureau of Land Management (BLM) for the right to construct, operate, and maintain water-diversion facilities on federally managed lands along the South Platte River approximately 25 miles southwest from downtown Denver, Colorado (Fig. I-1). These facilities are a part of a larger DWB proposal known as the Foothills Project. The proposal would allow the delivery of an additional 65,843 acre-feet (51,543 acre-feet from Dillon Reservoir, and 14,300 from the South Platte River) of treated water to the Denver area annually and would increase the DWB nominal treatment capacity by 125 million gallons per day.

The Foothills Project would use water stored during peak spring runoff in the existing Antero, Eleven Mile Canyon, Cheesman and Dillon Reservoirs. Most of the additional water used for the proposed project would originate from Dillon Reservoir. As needed, the west slope water would be released through the existing Roberts Tunnel and down the North Fork of the South Platte River, supplementing direct South Platte reservoir releases. The water would be diverted from the South Platte River by the proposed Strontia Springs Dam and Reservoir into a tunnel and conduit (No. 26) system to a treatment plant located more than 3 miles northeast (Fig. I-2). About 11 million kilowatt hours of hydro-electric power would be generated annually by the water near the terminal point of Conduit No. 26. "Raw" water would be treated and passed into another conduit (No. 27) for delivery to the Denver metropolitan area more than 16 miles

northeast (Figs. I-2, I-3, I-4). The proposal also includes an intertie conduit with the City of Aurora's water system.

Background and History

In the early 1900s plans were devised to divert and use water from the Upper South Platte and Blue Rivers to serve customers in the Denver area. Use of these water began with the construction of Cheesman Dam in 1905 and expanded in the 1930s with the purchase of Antero Reservoir and the construction of Eleven Mile Reservoir on the South Platte system. Then, in 1963, Roberts Tunnel and Dillon Reservoir were completed by the DWB for diversion of water to the east slope from the Blue River system. Serious plans for the proposed Foothills Project were initiated by the DWB during the period 1952-1955 with a preliminary survey of the Foothills Tunnel and the treatment plant site. In 1956, the DWB prepared the first plans for the Strontia Springs Diversion Dam and purchased 200 acres for a treatment plant. In 1957, Conduit No. 27 to Denver was surveyed. In 1962, the DWB filed its original application for those parts of Strontia Springs Diversion Dam and Reservoir, Conduit, and Tunnel on federally managed lands as a part of the proposed Foothills Project. A report (Black and Veatch, 1963) to the DWB recommended completion of the first treatment plant unit in 1977.

In 1967 the Bureau of Land Management (BLM) issued a right-of-way permit (C-099597) which allowed the DWB 5 years to construct the Strontia Springs Diversion Dam and Reservoir, Conduit, and Tunnel. After 1967, the DWB began preparation of detailed site studies, predesign, and survey work. These studies resulted in some significant changes in the original designs and led to a DWB request for an extension of time to construct. A BLM letter, dated 1973, granted an extension until 1974 within which to prepare and submit an amended application and complete construction.

The letter granting the extension recognized the need for analysis of the action after project designs were completed as required by PL 91-190, the National Environmental Policy Act of 1969 (NEPA). Water Board studies culminated with the Foothills Predesign Report in November 1973 and the Foothills Project, Environmental Impact Assessment in April 1974. In January 1974 the Board filed another request for a 1-year extension of time to prepare and submit an amended filing and for 3 years to construct. A decision was made by BLM to comply with NEPA prior to acting on the DWB request and after amended filings were received.

An amendment to the original right-of-way permit was received from the DWB in November 1974. A new application for road access to the proposed damsite across federally managed land was filed in October 1974. From these applications the Department of the Interior determined that the action as proposed could significantly affect the quality of the human environment and intiated preparation of this environmental impact statement, as required by Section 102(2)(C) of NEPA. In February 1975, the Department determined that this environmental impact statement should be project-specific in scope and consider the effects of construction and operation of the dam, reservoir, ancillary facilities in the canyon of the South Platte River, the treatment plant, and the water supply, along with delivery tunnels and conduits.

Description of The Proposed Foothills Project

General

The description of the proposed facilities which follows is composed of information obtained from The Foothills Project Environmental Assessment (DWB, April 1974), The Foothills Project Predesign Report (Foothills Project Consultants for the DWB, November 1973), BLM official case files for rights-of-way C-099597 (Strontia Springs Diversion, etc.) and C-22081 (Platte Canyon access road) and additional data supplied by DWB. All details in the description are current as of May 7, 1975.

The proposed construction of the entire Foothills Project would cost about $89 million (1975). Table I-4 reflects total resources which would be committed to project construction.

Table I-4

SUMMARY OF TOTAL PROJECT STATISTICS

Aggregate	300,000 tons
Cement	48,000 tons
Steel	10,000 tons
Water	90-100 acre-feet

The construction would employ as many as 460 persons working three 8-hour shifts 7 days a week (Fig. I-5). For purposes of impact analysis a probable construction schedule (Fig. I-6) was developed by the DWB from a hypothetical starting date of January 1, 1976, even though it is presently impossible to estimate when or if construction will actually begin.

When completed the proposed Foothills Project would divert and treat 90 to 125 million gallons of water per day for distribution and use in the DWB service area. The addition of the proposed Foothills plant would substantially change the DWB operation of existing plants. The Foothills plant would operate at near capacity year around to take advantage of its higher elevation and reduced pumping requirements. The Moffat and Kassler treatment plants would be used primarily to supply the peak demands of the summer; the Marston treatment plant would be utilized at full capacity during the peak season and to meet demands beyond the Foothills capability during the off-peak season.

The present reliable annual water supply from existing DWB storage is 298,000 acre-feet delivered to the intakes.1/ Use in 1974 (a dry high-use year) was 246,457 acre-feet and this use was met through overloading the present treatment plants. This left a surplus supply of 51,543 acre-feet, to be derived from Dillon Reservoir on the Blue River watershed. Bear Creek water rights and several South Platte Ditch rights would also be available, totaling an additional 14,300 acre-feet from the South Platte watershed via direct releases from Cheesman Reservoir.

1/ This amount of water was computed using the historical water supply conditions for the period 1947-1965. Regulation of this supply in present storage facilities was considered and the water was hypothetically routed through the water system and delivered to the metropolitan area in monthly increments similar to the historical water use distribution from month to month. With this month to month distribution and historical runoff conditions the existing supply system could reliably deliver 298,000 acre-feet of water to the metropolitan area annually. With the 14,300 acre-feet from added rights, 312,300 acre-feet would be available annually.

These available water rights total 65,843 acre-feet in addition to water presently supplied to the Kassler and Marston treatment plants from the South Platte. During the period 1964-1973, 117,900 acre-feet of water were treated annually at the Kassler and Marston plants. If the Foothills plant were to operate at a constant 125 mgd, a supply of about 142,000 acre-feet of water would be required annually. It is assumed for the purpose of this analysis that the difference between the 142,000 acre-feet and the 65,843 acre-feet, or 76,157 acre-feet of water annually, would be taken from the water presently being supplied to the Kassler and Marston treatment plants. This would leave 41,743 acre-feet to be treated annually, primarily at the Marston plant.

Operation and maintenance of the proposed system would require 25 additional permanent employees, all at the Foothills Treatment Plant Complex.

The proposed Foothills Project features are designed to accommodate expansion to a 500-mgd limit. This capability is built into all project components to make possible utilization of future additional raw water supplies which could be made available if an additional terminal storage reservoir were constructed upstream. The one exception is found in the distribution conduit (#27) which is designed to accommodate addition of only one 125 mgd unit to the treatment plant. Further expansion would require one or more additional conduits of a size and route to be determined by future growth patterns of the Denver area. Further discussion of this compatibility is found in the interrelationships section of this chapter.

The following data concerning individual project components have been abstracted from the detailed description of the proposal.

A. Dam and Reservoir

1. Dam

a. Height, above streambed--243 feet

b. Crest elevation--6,002 feet

c. Crest length--601 feet

d. Thickness--31 feet at the base, 10 feet wide at the crest

e. Excavation--130,000 cubic yards

2. Intake Towers (Denver Water Board and City of Aurora)

a. Denver intake--a hexagonal structure 35 feet thick at the base and 179 feet tall

b. Aurora intake--a square structure, 21 feet thick at the base and 123 feet tall

3. Reservoir

a. Normal capacity--7,240 acre-feet at 6,002-foot elevation

b. Silt-storage capacity--2,110 acre-feet (75-year life)

c. Surface area--95 acres at 6,002-foot elevation

d. Pool length--1.7 miles at 6,002-foot elevation

B. Access Roads and Staging Areas

1. Road Improvements

a. 22-foot wide gravel surface--16,400 feet

b. 14-foot wide gravel surface with turnouts--4,000 feet

c. 13-foot wide graded surface with turnouts--6,400 feet

2. Staging Area for Construction

a. Stevens Gulch--4 acres

b. East Portal--30 acres

C. Power and Telephone Lines

1. Dam and Stevens Gulch portal--13.2 kilovolt overhead line extended 2.8 miles with telphone lines on same poles

2. Treatment Plant and East portal--12.6 kilovolt overhead line extended approximately 2,500 feet with telephone line on same poles

D. Foothills Tunnel

1. Length--17,967 feet in three segments:

a. 1,705 feet of 10.5-foot diameter concrete-lined tunnel from the intake tower to Stevens Gulch

b. 170 feet of 10.5-foot diameter conduit in Stevens Gulch

c. 16,092 feet 10.5-foot diameter concrete-lined tunnel to the east portal

2. Excavation--143,000 cubic yards: 40 percent from Stevens Gulch portal, 60 percent from east portal

3. Aggregate needs--53,000 cubic yards

E. Treatment Plant Complex

1. Conduit No. 26 length--1,721 feet of buried 10.5-foot diameter pipe from the east portal to the treatment plant

2. Power generation--hydroturbine to double as energy dissipator in Conduit No. 26

a. Produce 11 million kilowatt-hours annually with 125-mgd flows

b. Treatment plant would use 8 million kilowatt-hours annually

c. Expected surplus power would be 3 million kilowatt-hours annually

3. Aurora intertie system

a. 2,450 feet of 54-inch buried conduit

b. 1,500 feet of 60-inch buried conduit

4. Treatment capacity--125 mgd

5. Plant structures

a. Eight above-ground improvements

b. Four underground structures

c. Area occupied by structures--65 acres

6. Sludge production--averages 7,125 pounds/day

7. Internal Access

   a. Asphalt surfaced road approximately 3,700 feet long (permanent)

   b. 2,600 feet of graveled road (temporary)

F. Conduit No. 27

1. Length

   a. 53,800 feet of 108-inch buried steel or concrete cylinder from the treatment plant to Highland Reservoir

   b. About 33,000 feet of 72-inch conduit from Highland Reservoir to Hillcrest Reservoir

2. Rights-of-Way

   a. 60,800 feet - 100 feet wide; 140 acres

   b. 10,000 feet - 80 feet wide; 19 acres

   c. 16,000 feet - Street right-of-way

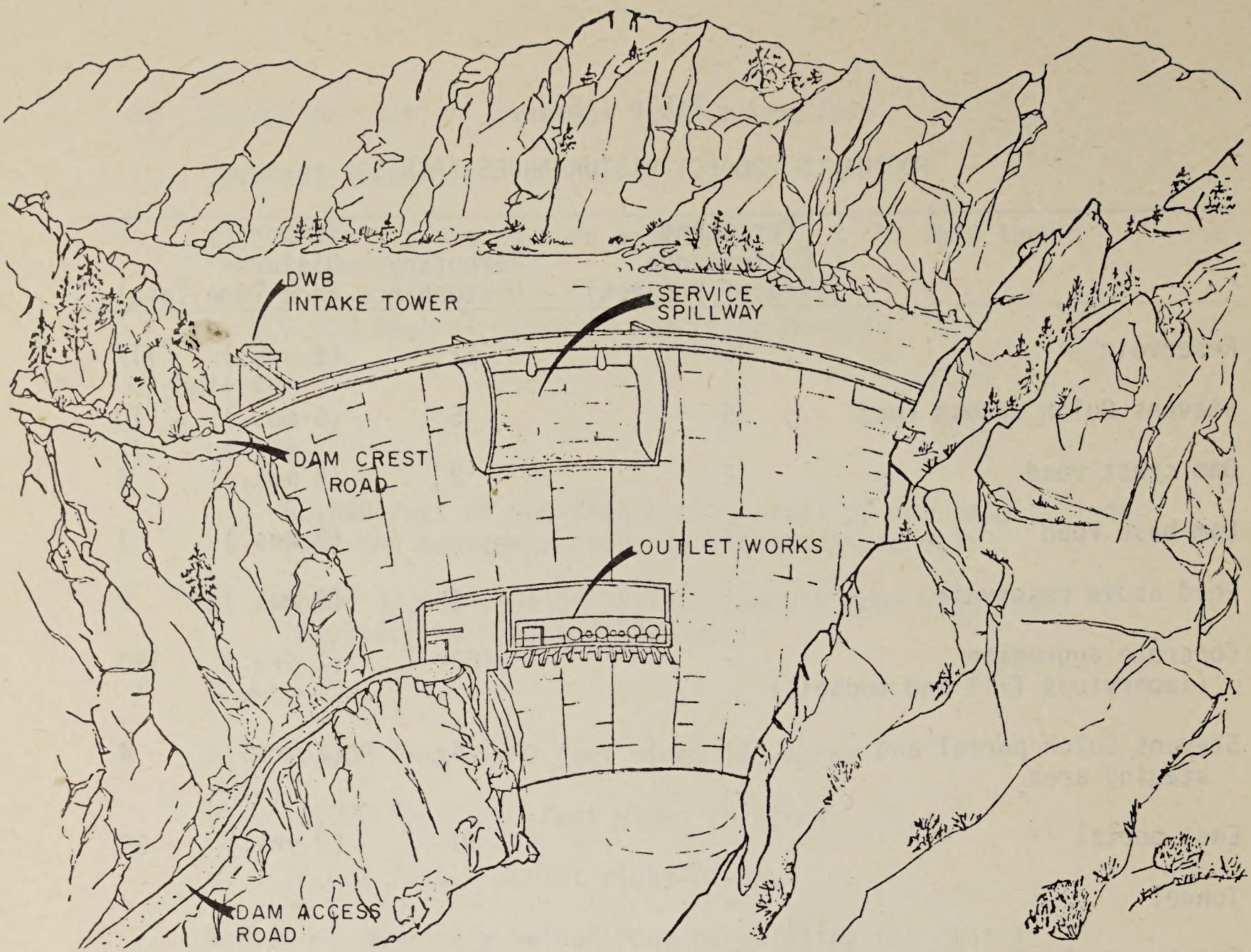
3. Access--a temporary balded road paralleling the conduit

As evident in the preceding abstract, the Foothills Project facilities would require and occupy a total of 169 acres of land for the life of the project. However, a much larger area would be disturbed by the construction activity. Table I-5 is a summary of estimated permanent and temporary disturbances proposed.

Table I-5

FOOTHILLS PROJECT DISTURBANCES (ACRES)

	Permanent Disturbance (Life of Project)	Temporary Disturbance	Temporary Disturbance Time	Total
Reservoir	95	22	(2 yrs.)	117
Stevens Gulch access road	5	5	(5 mos.)	10
Dam crest road	2	2	(5 mos.)	4
Dam base road	1	-	(5 mos.)	1
Road above reservoir	1	1	(5 mos.)	2
Concrete aggregate (impervious fill and topsoil)	-	150	(2 yrs.)	150
Stevens Gulch portal and staging area	-	4	(2 yrs)	4
East portal	-	30	(2 yrs.)	30
Tunnel	-	-	-	-
Treatment plant complex	65	80	(2 yrs.)	145
Power and telephone lines and roads	-	5	(6 mos.)	5
Conduit No. 27	-	105	(3 mos.)	105
Sludge disposal	-	5	(1 yr.)	5
TOTAL ACREAGE	169	409		578



PROPOSED STRONTIA SPRINGS DAM & RESERVOIR

PREPARED BY FOOTHILLS PROJECT CONSULTANTS

Figure I-7

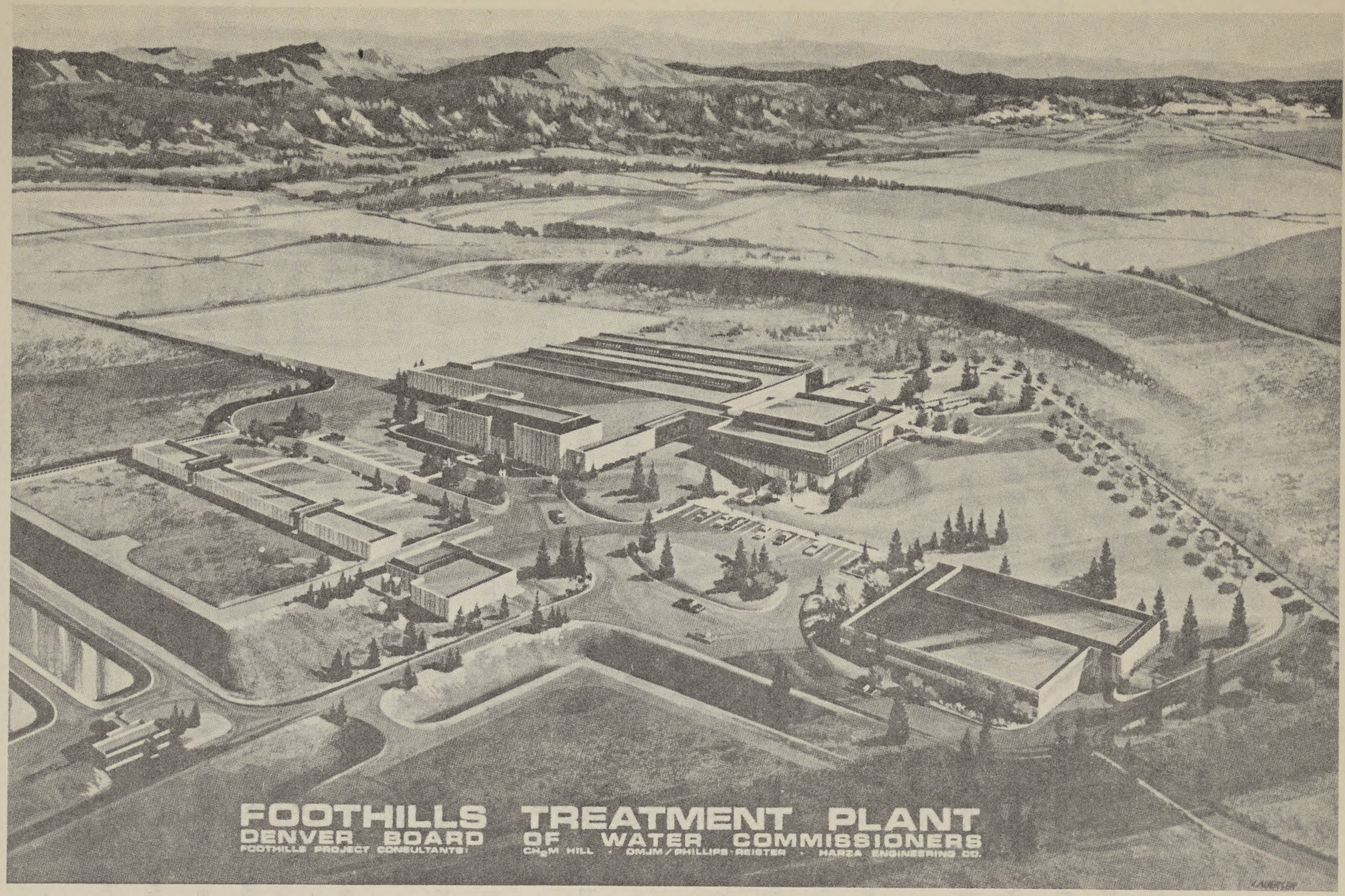

FOOTHILLS TREATMENT PLANT
DENVER BOARD OF WATER COMMISSIONERS
FOOTHILLS PROJECT CONSULTANTS:
CH2M HILL · OMJM/PHILLIPS·REISTER · HARZA ENGINEERING CO.

FIGURE I-14

Interrelationships with Other Projects and Proposals

The proposed Strontia Springs Diversion Dam and Foothills Water Treatment Plant would be directly related to the South Platte River water supply system. These facilities are not developments for additional water supply. Only existing water supplied by existing storage facilities would be diverted and treated by the proposed project. The South Platte system is one of the Denver water supply systems developed by the Denver Water Board to provide water to the Denver metropolitan area. The other sources are the Blue and Fraser Rivers.

The following discussion addresses existing and proposed water developments directly and indirectly related to the proposed water diversion and treatment project.

Existing Non-Federal Projects

Figure I-16 displays the DWB developments mentioned in the discussion and illustrates their relationships to the proposed action.

The proposed Strontia Springs Dam would divert water provided by the Dillon Reservoir-Roberts Tunnel and South Platte River major supply systems. Historically these systems have supplied 57 percent, or 117,900 acre-feet, of the 206,000 acre-feet of average annual water used in the DWB service area (1964-1973).

The North Fork of the South Platte River is part of the system that supplies water developed and originating west of the Continental Divide on the Blue River, which is a part of the Colorado River Basin. The DWB has diversion rights to store flows from the Blue River and the tributaries of Tenmile Creek and the Snake River.

DENVER BOARD of WATER COMMISSIONERS

*/ WATER SUPPLY SYSTEM

FIGURE I-16

*/ Source: Denver Board of Water Commissioners, Annual Statistical Report. Denver, Colorado, 1973, p. 17.

Planned Developments and Proposals

In October 1974 the Bureau of Reclamation published a filed draft feasibility report which presented an investigation of the Upper South Platte Unit, Pick-Sloan Missouri Basin Program, Colorado. Three alternative water storage facilities for the Denver metropolitan area are included in the investigation. These alternative damsites include West Plum Creek in the foothills, Ferndale on the North Fork of the South Platte River, and Two Forks in the South Platte River about 2 miles upstream from the proposed Strontia Springs Diversion Dam. No storage alternative has been selected for construction.

In addition to diverting water to the Foothills Treatment Plant, the Strontia Springs facility could serve as an afterbay for the Two Forks alternative of the Upper South Platte Unit and stabilize the power releases to the South Platte River. The Turkshead Dam referred to in the report would serve the same function as Strontia Springs Dam and would be required for the Ferndale and West Plum Creek alternatives also. Turkshead Dam, to be located 1.9 miles downstream from the proposed Two Forks damsite, would not be constructed if Strontia Springs is built. However, the primary purpose of Strontia Springs is for diversion of existing stored water supplies for treatment in the Foothills processing plant, and it could serve this function independent of any of the Upper South Platte Unit alternatives. The dam is designed with a spillway capable of passing the inflow-design flood without upstream storage. In addition, the outlet works and other appurtenant works are designed to function independently of additional upstream storage.

The report presented, for public and governmental evaluation, and engineering, economic, environmental, and social analysis of alternative water supply plans in the Upper South Platte River Basin. Although the report contains conclusions of the investigation, it does not recommend any administrative action. According to the report, "After a thorough review and public meetings, recommendations for action will become a part of the proposed report of the Regional Director of the Bureau of Reclamation" (Dept. of the Interior, Bur. of Reclamation, 1974, p. I-1). The report states,

> Facilities similar to those being planned as a part of the Foothills Project will be required with or without additional storage on the Eastern Slope. The facilities are necessary to collect and treat water from the South Platte Drainage to meet present and near term future water needs. This study assumes that the Foothills Project is a necessary part of a complete plan for collection and treatment of water; however, in our studies we have identified the site of the proposed Strontia Springs Dam as the Turkshead Damsite.

Therefore, the Denver Water Board's Strontia Springs Diversion Dam is compatible with the major storage options studied in the report, and the Strontia Springs Dam could serve the afterbay and/or diversion dam purposes outlined therein--should one of those options be favorably recommended by the Bureau of Reclamation and then approved and funded by Congress.

The DWB owns two conditional decrees for storage rights in the Two Forks Reservoir alternative discussed above. These decrees are for 145,133 and 191,235 acre-feet of water annually and have appropriation dates of January 18, 1905, and May 1, 1926, respectively. If Two Forks Reservoir were constructed these rights would become decreed and would be exercised by that proposed project. That water would then be available

for diversion and treatment by facilities of the proposed Foothills Project and make possible full utilization or expansion to the capacity of 500 million gallons per day. However, present supplies of raw water from existing storage are sufficient to operate the proposed treatment plant only at the 125 mgd level described in this statement. Future expansion of the treatment system is totally dependent on additional raw water supplies to be made available through additional East Slope storage.

In 1932 the Bureau of Land Management allowed a right-of-way grant for the DWB to construct and operate a dam and reservoir on BLM and Pike National Forest lands. This grant was for a structure similar in location and size to the Bureau of Reclamation alternative mentioned above as Two Forks, except that it would be essentially a single purpose water development for municipal and industrial purposes. The relationships mentioned above for the Bureau of Reclamation proposals parallel the DWB Two Forks proposal except that the Strontia Springs Dam would serve solely as a diversion. The DWB has continued to acquire lands and other rights from private land owners in the area of this right-of-way. However, they have delayed planning and predesign efforts pending a final decision by the Bureau of Reclamation regarding construction of one of the major storage alternatives in the Upper South Platte study area. Should the DWB decide to proceed with these plans, the Bureau of Land Management would be required to comply with P.L. 91-190, the National Environmental Policy Act of 1969.

II. DESCRIPTION OF THE ENVIRONMENT

Present Environment

The description of the environment is organized into 12 categories which relate to all classes of land ownership. In each category are described the aspects of the environment which would most likely be affected by the proposed Foothills Project. The degree of detail in the description relates directly to the degree of anticipated impacts.

The area that probably would be affected by the Foothills Project generally includes the Denver metropolitan area, a linear area extending from Hillcrest Reservoir in Littleton southwesterly to the proposed treatment plant site near Roxborough Park, the South Platte Canyon from Chatfield Reservoir to South Platte and the North Fork of the South Platte River. Dillon Reservoir, the Blue River, and the South Platte River below Denver are described to a much lesser degree.

Socio-Economic Conditions

Human Populations

The socio-economic environment relating to the Foothills Project is centered around the Denver metropolitan area and is composed of six counties: Adams, Arapahoe, Boulder, Denver, Douglas, and Jefferson. The Denver metropolitan area is the largest in the Rocky Mountain states. The median population in 1970 for the six counties in the Denver area was 173,965, with the range being from 8,407 in Douglas to 514,678 in Denver (Table II-1). The total population of the six counties was 1,235,936.

The range in population densities in 1970 was from 10 persons per square mile in Douglas County to 5,418 persons per square mile in Denver County. The population density for the entire Denver area in 1970 was

Future Environment Without the Proposed Action

The description of the future environment without the proposed Foothills Project is based on several important assumptions derived largely from historical data and trends established in the past:

1. The total amount of raw water reliably available to the DWB for treatment will remain at 312,300 acre-feet annually.
2. Human population in the DWB service area will continue to grow as projected by the DWB.
3. As long as raw water is available the current trends in water use patterns will continue, resulting in an average annual use equalling 211 gallons per capita daily.

The future environment as described is based on conditions that are predicted to occur in the foreseeable future. These predictions in turn are based largely on projected population growth for the DWB service area (Table II-27) at periodic intervals between 1980 and 2013. The description of the future environment is limited to the period between the present and the year 2013.

TABLE II-27

PROJECTED PER CAPITA CONSUMPTION OF WATER AND NUMBER OF DAYS WHEN WATER DEMAND WOULD EXCEED SUPPLY[1/]

Year	Population in the DWB Service Area	Raw Water Consumed (acre-feet)	Per Capita Consumption of Raw Water Available (gal/person/day)	No. of Peak Days When Demand Exceeds Treatment Capacity
1975	861,322	203,271	211	0
1980	1,052,663	245,288	200	31
1985	1,284,249	287,433	199	51
1988 (est.)	1,345,900	295,818	199	58
1990	1,404,550	301,409	198	62
1995 (est.)	1,540,000	312,300	181	--
2000	1,680,276	312,300	165	--
2013	2,037,653	312,300	137	--

1/ Based on a fixed supply of raw water of 312,300 acre-feet annually.

Socio-Economic Implications

The DWB's capability to treat and deliver water to its service area would continue at present rates (490 million gallons per day until about 1978, when that capacity would increase to 520 million gallons per day with the completion of distribution conduits from the Moffat Treatment Plant). Within the next few years the DWB's ability to supply treated water would begin to fall short of demand and by 1980 the population in its service area would experience 31 shortage days (Table II-27). The number of shortage days each year would increase to 73 in the year 1990 and thereafter daily water shortages would be common. By 1995, the DWB would be treating all of the available raw water supply (312,300 acre-feet annually) and at that point the raw water supply, rather than treatment capacity, would become the dominant limitation on the system.

As the number of shortage days increased, there would be a corresponding decrease in per capita daily water usage (Table II-27). As a result, an average annual per capita use would decline from the present 211 gallons per day to 137 gallons per day by the year 2013. In addition, the historical pattern of monthly water consumption expressed as a percentage of the total amount of water used annually would begin to change as the number of peak demand days increase (Table II-28). The percentage of the total annual water supply consumed during the warm months would decrease while the percentage consumed in the cooler months would increase.

TABLE II-28

PROJECTED MONTHLY PERCENTAGE OF THE ANNUAL
WATER SUPPLY DELIVERED BY THE DWB

Months	Average 1965-1974	1988	1995
January	4.7	5.1	5.5
February	4.3	4.7	5.0
March	5.3	5.7	6.2
April	6.8	7.2	7.9
May	10.4	11.2	9.7
June	12.9	11.6	11.5
July	14.9	13.3	13.1
August	14.6	13.1	12.9
September	9.6	10.3	9.0
October	6.7	7.2	7.8
November	5.0	5.4	5.8
December	4.8	5.2	5.6

In the above exposition, water consumption patterns were held constant. Viewed more realistically the projected consumption patterns would be changed through a combination of a priority water allocation system and an education and conservation program. It is assumed that prior to 1980 a water allocation priority system would be necessary on peak demand days until a complete education and conservation program could be implemented. In order to assure high priority uses--fire protection, health, essential utilities, and industries--of an adequate supply of water during shortage days, it would be necessary for law enforcement personnel to patrol residential areas to prevent consumption of water in non-essential uses.

According to the DWB's Annual Statistical Report for 1973, 51 percent of the water delivered went to commercial and industrial uses, fire protection, city, county, state, and federal agencies, and system losses; the remaining 49 percent was used in residences. The average residential occupant used about 103 gallons daily.

Through conservation methods and devices, water used for irrigation would be reduced by 75 percent and that used for toilet flushing and bathing, cleaning and laundry, and miscellaneous uses by 50 percent (Flack, 1975). It is assumed that water used for life functions could not be reduced significantly. Thus, the average residential user could reduce his consumption of water by 43.3 percent from 103 gallons per day to 57 gallons per day.

In the future the DWB would have an assured year-long supply of 279 million gallons per day of which 51 percent could be alloted to non-residential uses--it is assumed that, for the most part, the percentage required for fire protection, commercial and industrial uses and various government agencies would be left for residential consumption. At a daily

rate of consumption of 57 gallons per day per capita the theoretical maximum population that could be supported without the project would be 2,416,226.

The major impacts of water shortage days on commerce, industry, and government could be theoretically delayed until about 2010 by implementing a successful water conservation program. When water shortages became acute enough for water rationing to be implemented, a priority system would probably be established. High priorities for access to water would probably be assigned to:

1. Fire fighting
2. Medical facilities (hospitals, nursing homes, doctors, etc.)
3. Public education facilities
4. Institutions for the elderly, handicapped, and children
5. Residential use (life functions)

Peak demand day shortages in the future would require that law enforcement personnel actively enforce emergency measures to ensure that high priority consumers such as fire protection and health agencies were not deprived of necessary water. These added responsibilities would necessitate using a larger proportion of the police force for routine patrols related to water usage.

The Constitution of the State of Colorado assigns industry the lowest priority for access to water, after domestic and agricultural uses. During crisis periods of water shortages, low priorities would cause industries that are dependent on the DWB for their daily water service to lay off employees on days when there would not be enough water to meet their needs. Employee layoffs would lead to lower annual incomes and lower living standards for affected employees.

It can be assumed that in spite of an expected growth in the annual volume of wastewater flowing out of the Denver area, the quality of the water would be greatly improved because of enlarged treatment facilities that would be technically superior to the present plants. The amount of wastewater flowing out of the Denver area would continue to increase until 1995 as increased amounts of water were consumed by the growing population. At present, wastewater treatment is substandard. However, this condition should improve after completion of the 6-year construction program of the Metropolitan Sewage Disposal District No. 1. This program is presently underway and is designed to improve wastewater treatment (City and County of Denver, 1974). In addition, the Federal Water Pollution Control Act Amendments of 1972 require that waste treatment systems be evaluated to ensure the "best practicable wastewater treatment tehnology" by July 1, 1983. It can be expected that the Sewage Disposal District will comply with the law.

The need for utilities in the Denver area would grow as a function of population growth. Natural gas supplies which are presently in short supply probably will become a scarce commodity. Even though artificial gas processed from coal would be used to supplement existing supplies, a trend toward the use of alternate energy sources is anticipated. Electrical energy would be the dominant form of energy used. Improved technology in the field of electric energy generation is expected to provide adequate energy for future population.

Among environmentalists, "restricted growth" factions, and those who are opposed to drawing additional water from the western side of the Continental Divide, a decision to not construct the project would probably produce

positive attitudes. Among those who want unrestricted development of the Denver area, there would probably be negative attitudes toward the decision.

Life styles in the Denver area would continue in the traditional way except that adjustments to accommodate water shortages would be made. The society would be a stratified and/or a graded one containing social and economic extremes, with those in the lower strata enjoying less elaborate life styles than those in the upper strata. As a result of water shortage there would be an increasing number of days in which irrigation would not be permitted. In addition, it would be quite likely that water for irrigation would be too expensive for the average consumer. New horticultural practices would utilize native plants that require little or no irrigation, thus replacing irrigated lawns.

III. ENVIRONMENTAL IMPACTS OF THE PROPOSAL

This chapter identifies and analyzes unmitigated impacts of the proposed Foothills Project. Each impact is analyzed in a cause and effect manner, and secondary impacts are identified and traced as far as practical.

The cause identified is tied to a component of the project proposal (Chapter I) and the effect identified is tied to a component of the environment (Chapter II). Existing environmental data were used to assess temporary or short term impacts while both existing and future environmental data were used to assess permanent or long term impacts.

Socio-Economic Conditions

Human Populations

As proposed the Foothills Project would not effect future population trends in the Denver metropolitan area. This conclusion is based on the following rationale. In the preceding description of the future environment without the project (pp. II-146 to II-161), it is shown that present raw water supplies would be used by 1995 (though peak day demands could not be met) even if the Foothills Project is not built. With the project, this supply would be used 7 years sooner by 1988. The analysis also shows that by 1995, average annual per capita consumption will decline from 211 gallons per day to 181 gallons per day with or without the project. A more complete analysis is shown later in this Chapter (pp. III-5 to III-8). Table III-2 shows that the largest difference in per capita consumption with and without the project would be 11 gallons per day in 1980; the first year after project completion. The proposed Foothills Project would neither develop new supplies of water nor allow for use of present supplies that, in a few years, would not be fully utilized without it. Because of this and the insignificant differences in per capita consumption it can be concluded that the project would neither cause nor permit additional population growth in the Denver area.

Employment/Manpower

The unemployed population living in the Denver area in December 1974 was 24,500. Since the maximum number of workers employed during the construction of the project would be about 460 people (Fig. I-6), the net effect of the construction of the project on unemployment in the Denver area would be to reduce it by about 1.9 percent during the peak hiring period.

An average of 400 workers would be employed over the 3-year construction period, resulting in an average reduction of the unemployed population of about 1.6 percent.

It is estimated that 25 people would be employed during the operation and maintenance period of the project. This would amount to a reduction of about 0.1 percent in the unemployment in the Denver area for the life of the project (75 years).

Construction of the Foothills Project would probably result in work-related accidents involving vehicles and workers. Table III-1 summarizes the anticipated accidents causing lost time that probably would occur during construction and operation of the project. During the 3 years of construction an estimated forty-three accidents would occur, each resulting in injury with loss of at least one subsequent work day. It is estimated that, during the 75-year life of the operating facility, there would be as many as twenty accidents involving motor vehicles involved in supplying the treatment plant with supplies and chemicals. Transport trucks hauling chlorine would probably be involved in about seven accidents and ammonia transports would probably be involved in about three accidents (Table III-1). Although statistics are not available to predict the frequency of serious vehicular collisions or major accidents that might result in a toxic chemical spill, the DWB has indicated that it has never experienced a motorized transport accident which resulted in spilled toxic chemicals. Spilled toxic chemicals such as chlorine or ammonia would affect air quality.

In general accidents would be expected to occur at the rate of once every 11 years for chlorine transports and once every 22 years for ammonia transports. Because of the way the transports are designed, it is improbable that a rupture and chemical spill would occur.

TABLE III-1

ANTICIPATED LOST TIME ACCIDENTS
DURING CONSTRUCTION AND OPERATION OF THE FOOTHILLS PROJECT

Type of Work	1974 Accident Rate in Incidents per 1,000,000 Hours Worked 1/	Probable Number of Accidents Related to Construction of the Foothills Project	Probable Accidents during 75 years of Operation
General construction (approximately 300 workers annually)	13.50	21	Not applicable
Underground mining (approximately 50 workers annually)	25.26	6	Not applicable
Motorized transport (trucks)	9.36 2/	16	20 3/

1/ National Safety Council, 1974.

2/ Units in incidents per one million miles.

3/ Breakdown of accidents related to transport trucks includes the following: (1) Chlorine transports--7 accidents; (2) Ammonia transports--3 accidents; (3) Other supply transports--10 accidents. Based on an average distance of 40 miles per delivery according to delivery frequency cited in Table I-7.

Income

The estimated cost of constructing the project would be about $89 million, which would be expended over a 3-year period. This would amount to an average of about $30 million annually. The estimated total gross 1975 domestic product in the Denver area is $7,277,400,000 (DRCOG, 1974c). Therefore, if the entire expenditure for the project were local, it would have the direct effect of adding 0.4 percent to the gross domestic product. There would also be undetermined multiple effects.

Over the 3-year construction period, however, there would be significant human impacts on approximately 400 families and/or individuals (the average number which would be hired during the construction period) that would receive average annual gross incomes of about $14,500. Also some local subcontractors would receive, from an individual point of view, significant income.

During the operation and maintenance period the impact on gross income earned in the Denver area would be slight since it would involve only twenty-five workers, all at the treatment plant. However, the impact on families of these workers would be significant; they would be assured a steady income which traditionally has been a key variable in a stable family life.

Water Supply Facilities

The impact of constructing the project on the water supply facilities in the Denver area would be to increase treatment capacity by 125 mgd. This extra capacity would postpone shortages caused by peak demand days from 1980 to 1985. From 1985 on, however, there would be shortages on some peak demand days with the project, but not as many as without it until about 1995.

The effect of this would be to allow present average per capita consumption of water to continue until about 1985 (Table III-2). The additional treatment capacity would allow per capita consumption to exceed that without the project until 1995. Beyond 1995 the consumption rate would be unaffected by the project owing to a lack of raw water supply. An additional effect would be a change in the proportion of water used on a monthly basis, with higher percentages of the total water supply being used in the warm months and lower percentages in the cool and cold months (Table III-3) until 1995. These consumption trends would continue until sometime between 1990 and 1995, when the average per capita amount of water available would be the same with the project as without it.

The impact of the project on the water priority allocation program and the conservation and education program would be to delay them for about 5 years, or until about 1985, versus 1980 without the project. By that time the water priority allocation system would be an absolute necessity on shortage days in order to assure that high priority consumers would have water.

Wastewater Treatment Facilities

The Foothills Project should have no measurable impact on wastewater treatment facilities. Sewage loading is a function of population, and not a function of peak day demand. Peak day demand uses of water from this proposed project would be used primarily during July and August largely for irrigation purposes. A large part of this water would be lost to evapotranspiration and not returned to the South Platte River. Since the project would have a negligible impact on growth and population, there should be no increased demand on sewage treatment plants as a result of the project.

TABLE III-2

PROJECTED PER CAPITA CONSUMPTION OF WATER AND NUMBER OF DAYS WHEN WATER DEMAND WOULD EXCEED SUPPLY 1/

Year	Population of DWB Service Area	Raw Water Consumed and Available (acre-feet)		Per Capita Consumption of Raw Water Available (gal/person/day)		Theoretical Number of Peak Days when Demand Exceeds Treatment Capacity	
		Without the Project	With the Project	Without the Project	With the Project	Without the Project	With the Project
1975	861,322	203,271	203,271	211	211	0	0
1980	1,052,663	245,288	248,886	200	211	31	0
1985	1,284,249	287,433	301,119	199	209	51	20
1988 (est.)	1,345,900	295,818	312,300	199	207	58	27
1990	1,404,550	301,409	312,300	198	199	--	--
1995 (est.)	1,540,000	312,300	312,300	181	181	--	--
2000	1,680,276	312,300	312,300	165	165	--	--
2013	2,037,653	312,300	312,300	137	137	--	--

1/ Based on a fixed supply of raw water.

TABLE III-3

IMPACTS ON PERCENTAGE OF ANNUAL WATER SUPPLY CONSUMED BY MONTH

Month	Historical Use	Use by 1988		Use by 1995	
		Without Project	With Project	Without Project	With Project
January	4.7	5.1	4.7	5.5	5.5
February	4.3	4.7	4.4	5.0	5.0
March	5.3	5.7	5.4	6.2	6.2
April	6.8	7.2	6.9	7.9	7.9
May	10.4	11.2	10.6	9.7	9.7
June	12.9	11.6	13.1	11.5	11.5
July	14.6	13.3	14.3	13.1	13.1
August	14.6	13.1	14.0	12.9	12.9
September	9.6	10.3	9.8	9.0	9.0
October	6.7	7.2	6.8	7.8	7.8
November	5.0	5.4	5.1	5.8	5.8
December	4.8	5.2	4.9	5.6	5.6

Water

Surface Water

During construction of the proposed Foothills Project (3 years), 90 to 100 acre-feet of water would be used from the South Platte River. The present discharge of the river at the point of withdrawal (near Stevens Gulch) is about 292,700 acre-feet annually. Therefore, the flows during the construction period would be reduced to about 292,677 acre-feet annually. The effect of this loss would be so small as to be immeasurable, although it would, at 211 gallons per person per day, be enough water to sustain about 420 persons annually.

The recurrence interval of a storm that would result in discharges through the South Platte Canyon exceeding the capacity of the diversion tunnel would be 25 years (Table II-10). If, during construction of the dam, flows through the canyon exceeded 4,400 cubic feet per second, water would back up and wash out the upstream cofferdam. The surge of water would flood the work area at the damsite, destroying equipment, washing out the downstream cofferdam, and possibly taking the lives of any workers in the area. The contents of the sediment basin--grease, concrete and other debris, along with 6,700 cubic yards (8,040 tons at 1.2 tons per cubic yard) of material used to construct the cofferdams--would be immediately swept downstream into Chatfield Reservoir. There would be no long term adverse impacts which would accompany a storm of this magnitude without the project, except that about 8,040 tons of sediment would be added to the 70,000 tons which the South Platte River normally carries annually. This would represent a short term increase of 11.4 percent to 1 year's sedimentation in Chatfield Reservoir.

Population projections and a fairly constant per capita consumpton rate lead to a conclusion that operation of the proposed Foothills Project would result in diversion of the entire 51,543 acre-feet of additional water annually from the Colorado River Basin to the Missouri River Basin in 1988. This accelerates by about 7 years the diversion of the full amount of raw water currently available from existing storage annually. Without the project only 34,200 acre-feet of additional water would be diverted through the Roberts Tunnel in 1988, but with the project 51,543 acre-feet would be diverted. The difference, 17,343 acre-feet, would be lost to the Colorado River system. Table III-4 projects average annual discharges at key gaging stations with the project and offers a comparison to discharges without the project. The 17,343 acre-feet of water diverted from the Colorado River Basin in 1988 as a direct result of the project would reduce the future flows of the Colorado River at the Colorado-Utah line by about 0.73 percent 1/ during May and June, when most of the water would be stored in Dillon. The reduction in flows in the Colorado River Basin would cause extremely small, immeasurable impacts on the Blue River, Green Mountain Reservoir and Colorado River. In addition, the removal would not measurably affect power generation capabilities of the system, and is part of Colorado's water allocation from the Colorado River system. This amount of water normally is transported down the system during these months of peak runoff, usually May and June.

1/ The present flow at the Colorado-Utah state line is 2,371,000 acre-feet.

TABLE III-4

PROJECTED AVERAGE ANNUAL DISCHARGES AT KEY GAGING STATIONS

Gaging Station	Historical 10-Year Average (cfs)	(acre-ft)	1988 Without Project (cfs)	(acre-ft)	1988 With Project (cfs)	(acre-ft)	1995 Without Project (cfs)	(acre-ft)	1995 With Project (cfs)	(acre-ft)
North Fork of the South Platte River at South Platte (natural flow)	157	113,900	157	113,900	157	113,900	157	113,900	157	113,900
Roberts Tunnel	41	29,600	88	63,800	112	81,100	112	81,100	112	81,100
North Fork of the South Platte River at South Platte (including Roberts Tunnel imports)	198	143,500	245	177,700	269	195,000	269	195,000	269	195,000
South Platte River at South Platte	412	298,000	463	332,500	483	349,500	438	349,500	438	349,500
South Platte River below Denver (includes sewage return and Clear Creek)	649	469,500	676	489,000	676	489,000	690	499,000	690	499,000

Historical data indicate that increased diversions from Dillon Reservoir through the Roberts Tunnel and into the North Fork of the South Platte River would be greatest during July and August, when the maximum demands for treated water would exist. Table III-5 projects the monthly average discharge of the North Fork, including Roberts Tunnel imports, and offers a comparison to the projected discharge without the project.

In addition, it is probable that flows in the North Fork would be increased as much as 193 cubic feet per second when all treatment plants were operating at maximum capacity during those same periods of maximum demand. In 1988, flows with the project would exceed those without the project on a total of 58 days when, without the project, peak demand would exceed capacity. With the project, peak demand is predicted to exceed capacity on only 27 days. These conditions would build from the completion of the project in 1979 to about 1988, then decrease to 1995 when flows would equate those without the project. Without full cross-sections of this portion of the stream these impacts are impossible to quantify.

During 1988 average July flows on the North Fork would be increased from 436 to 482 cubic feet per second. During that same year average flows would be increased from 244 to 268 cubic feet per second (Table III-5). During summer months, the increased flows on the 15 unstabilized miles of the North Fork could increase bank erosion, lower recreation values, and destroy riparian vegetation.

TABLE III-5

PROJECTED MONTHLY AVERAGE DISCHARGE
OF THE NORTH FORK OF THE SOUTH PLATTE RIVER 1/

Month	Historical 10-Year Average (cfs)	1988 Without Project (cfs)	1988 With Project (cfs)	1995 Without Project (cfs)	1995 With Project (cfs)
January	67	95	106	113	113
February	58	87	99	104	104
March	69	101	114	121	121
April	127	168	187	195	195
May	375	437	464	454	454
June	490	557	603	589	589
July	362	436	482	474	474
August	348	421	465	459	459
September	182	241	267	257	257
October	123	163	180	198	198
November	93	124	137	143	143
December	73	102	114	120	120
Annual average	198	244.3	268.2	268.9	268.9

1/ Including Roberts Tunnel imports.

As a result of project operation an additional 17,343 acre-feet of water would be diverted through the Roberts Tunnel into the North Fork in 1988 (Table III-6). This operation would increase the fluctuation of Dillon Reservoir by approximately 3.5 feet during that year, resulting in a decrease of 102 surface acres and a corresponding increase in mud flats. It should be noted that the drawdown in Dillon Reservoir would approach 23 vertical feet without the project in 1988. At this same point in time the Foothills Project water requirement would result in a drawdown to 26.5 feet.

By 1995 the drawdown with the project would equate the projected drawdown without the project, after which no further difference would be predictable. It is recognized that there would be a reduction in aquatic habitat and a reduction in the number of surface acres available for recreational use during the time when the project imported additional water. Impacts resulting from the change in surface acreage of Dillon Reservoir could not practically be separated from those that may occur without the project, especially when viewed as only short term differences.

Behind the proposed Strontia Springs Diversion Dam, a new 95-acre artificial lake would be created in place of the existing 1.7 miles of South Platte River. This new lake would exist for at least the 75-year life of the project and probably beyond, since removal and salvage of the dam seem impractical at this time. This would affect aquatic life, geology, minerals and topography, water quality, terrestrial habitats, noise, aesthetics, cultural resources, recreation, and land use.

TABLE III-6

PROJECTED ANNUAL MAXIMUM DRAWDOWN
OF DILLON RESERVOIR

	Reservoir Content (acre-ft.)		Vertical Drawdown (ft.)		Surface Area (acres)		Estimated Acres of Mud Flats	
	Without Project	With Project	Without Project	With Project	Without Project	With Project	Without Project	With Project
Typical Historial Year (1972)	220,100	--	11.2	--	2,829	--	404	--
1988	189,000	179,000	23.0	26.5	2,497	2,395	736	838
1995	179,900	179,000	26.5	26.5	2,395	2,395	838	838

Since the treatment plant would be used as a base plant to meet sustained instead of peak demands for treated water, a part of the water that up to now has been diverted downstream at the existing Platte Canyon and Highline Canal diversion structures would be diverted at the proposed damsite. This would amount to about 140,000 acre-feet of water annually, or an average of about 193 cubic feet per second. Average annual flows during the 75-year project life would be reduced from 463 cubic feet per second without the project to 290 cubic feet per second in the 2.6-mile section of river between the Strontia Springs site and the lower diversions, which would then continue to take out water to meet peak demands. These reduced flows would impact aquatic life and recreation. Flows downstream from the Highline Canal Diversion would not be affected by the diversion.

The flows of the South Platte River below Denver would not increase measurably in the future as a result of the proposed project. The future increases shown in Table III-4 correspond to future increases without the project. These increased flows are a function of population growth which would occur without the project as described in the socio-economic section of this analysis.

Operation and maintenance of the treatment plant complex would require about 5 acre-feet of water annually, primarily for irrigation of 4 acres of ornamental shrubs, grass, etc. This water would be unavailable for other uses such as residential. At 211 gallons per person per day, 5 acre-feet of water annually could be used to sustain 21 persons annually. The grass areas would impact aesthetics and terrestrial habitats.

IV. MITIGATING MEASURES

Introduction

The mitigation measures analyzed in this chapter are actions which would in some way reduce or eliminate an impact identified in Chapter III. Each measure is analyzed in relation to a specific component of the proposed action and a determination is made as to how it would affect the specific environmental impact involved. The mitigating measures will be required when and if the proposed project is approved.

Mitigating measures are limited to those which the DWB has included as nonstructural proposals, called "applicant-committed," and those which would be required by governmental agencies with jurisdiction by law, called "proposed governmental requirements," over which an agency besides BLM or the USFS has jurisdiction. Mitigating measures to be analyzed in this manner relate to the east portal and staging area, the treatment plant complex, and Conduit No. 27. In this case the applicant-committed measures would not be enforced by any specific entity but are those measures the applicant has committed itself to.

In the area of the South Platte Canyon all mitigating measures, including those proposed by the applicant, concerning USFS, BLM, and private lands would be included in the right-of-way permit should one be issued. The project components in the canyon include the access roads, the Stevens Gulch staging and portal area, the Strontia Springs Dam and Reservoir, and the power and telephone lines. Measures identified relative to these project components would be made conditions or stipulations of the permit and would be enforced jointly by BLM and USFS personnel. Requirements over which other agencies would have enforcement authority are identified in

the text. Those which would be enforced by the BLM and for the USFS are not noted except by omission.

In areas of private land, remote from federally managed lands, mitigating measures analyzed include those proposed by the DWB.

V. ADVERSE IMPACTS THAT CANNOT BE AVOIDED

This chapter presents a discussion of unavoidable adverse impacts which would be caused by construction and operation of the proposed Foothills Project. These include the residual impacts after application of the mitigating measures discussed in the preceding chapter. To avoid bias those impacts which involve judgment based on personal opinion as to their adverse nature are brought forward and identified.

The following analysis is based on the assumption that the Denver Water Board would act in good faith in utilizing its proposed mitigating measures, which would not be included as conditions of any license or permit. If the DWB failed to implement adequately those applicant-committed measures, the unavoidable adverse impacts analyzed here could approach the unmitigated impacts identified in Chapter III.

VI. THE RELATIONSHIP BETWEEN LOCAL SHORT TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG TERM PRODUCTIVITY

This chapter discusses the productivity of the environment which would be affected by the construction and/or operation of the proposed Foothills Project. In this context, "short term" refers to the 3-year construction period which would be required to construct the components of the Foothills Project and "long term" refers to the estimated 75-year project life. Beyond 75 years the dam and reservoir would probably continue to affect productivity since the removal of this structure would be of questionable practicality. It is assumed that other above ground, permanent facilities would be removed and partially salvaged and the affected areas reclaimed.

In total, about 554 acres of land in a naturally productive state would be disturbed during construction, of which 76 acres would be occupied by man-made buildings, roads, trails and structures and 95 acres would be transformed from stream aquatic and terrestrial habitat to reservoir aquatic habitat. Uses on the remaining 383 acres would be modified temporarily or disturbed by short term construction-related activities.

The short term uses on the 383 acres would reduce natural productivity during construction and a 3- to 5-year restoration period. During this time about 447 tons of natural biological production would be lost. Long term annual production thereafter would be unaffected. The occupation of 76 acres by structures would eliminate natural productivity and result in a long term net loss of 2,360 tons of biomass.

Filling of the proposed reservoir would inundate 95 acres of terrestrial habitat and replace it with a relatively sterile aquatic habitat. Although the present fish production per acre would be reduced, total fish production

of 896 pounds in the 1.7 miles of stream inundated would be increased approximately two-fold--to 1,995 pounds--in the 95-acre reservoir. All terrestrial biomass, estimated at 4,000 tons, would be lost during the 75-year project life and, since it would remain afterwards, the dam would continue to reduce biotic production about 42 tons annually thereafter. Additionally, natural trout reproduction in the 1.7 miles of stream inundated would be lost entirely and not replaced by the reservoir. The short term construction uses in the Platte Canyon would affect long term land uses on 117 acres (to high-water line) by eliminating most land use options in the future. However, casual land uses such as recreational and wildlife use would continue. Of the 117 acres, 38 acres would be federally managed and on them multiple uses would be restricted to those associated or compatible with the primary water diversion purpose.

The removal of vegetation and associated soil disturbances would increase sediment yield by 1,752.6 tons in the short term construction and restoration period. As vegetation became reestablished sediment production would stabilize at a near natural level. During the construction and restoration period, 397.5 tons of the additional sediments would be added to a 2.6-mile stretch of the South Platte River. Trout production would be reduced in this area and production would be totally lost from the area dewatered for dam construction. During the 3-year period a total of 1,020 pounds of trout would be lost. This would not affect long term productivity per acre. Associated with construction in the South Platte Canyon would be the loss of about 50 head of Bighorn sheep. In the long term the herd would regain its present level of 80 head and production would return to present levels.

Human interest values would be significantly impacted during both the short and long term periods. Closure of the South Platte Canyon to public use during the 3 years of construction would eliminate 15,000 visits for recreation use, aesthetic enjoyment, and cultural exploration. Over the long term and beyond, although the canyon would be re-opened to public use, the use productivity would be changed from those opportunities associated with a free-flowing stream in a rugged, relatively untouched setting to one dominated by the dam, reservoir, and other man-made facilities. There would be a complete loss of the opportunities to view and study 1.7 miles of the Denver and Rio Grande and DSP&P railroad grades, Deansbury Station, and the Strontia Springs historical features. An additional 2.6 miles of the DSP&P railroad grade would be modified, and the Keystone bridge would be removed for placement at another appropriate site. Cumulatively, these losses would almost eliminate future activities associated with cultural resources in the South Platte Canyon.

East of the Foothills Project site there would be a loss of opportunities to view and study the short section of Colorado and Southern railroad grade and known and as yet undiscovered archeological sites and paleontological resources. Although these cultural resources would be identified and recorded during construction, the options for future interpretation and study would be lost.

Operation of the Foothills Project features would result in the use of a total of 144,828 acre-feet1/ of additional water for municipal and

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1/ Computed from annual differences for the 1980-1995 years shown in Table III-2. Differences for intermediate years were derived by interpolation so that the cumulative loss could be calculated.

industrial use between 1980 and 1995 because of increased treatment capacity. Of this amount about 28 percent would come from the South Platte System and about 72 percent would come from Dillon Reservoir via the Roberts Tunnel. The 105,724 acre-feet from Dillon Reservoir would represent a complete loss to the Colorado River system in Colorado. This loss would be used solely to maintain present life styles in the Denver area through 1988.

Although silt would be added during the short term construction period, the proposed dam would trap 2,110 acre-feet of silt annually over the 75-year project life and reduce turbidity in 2.6 miles of the South Platte River below that point. This probable improvement in aquatic habitat would be more than offset by the reduction in flows in that area. Trout production would be reduced by 10 percent, or 95 pounds annually, for a total loss of 7,125 pounds of trout during the long term 75-year life of the project.

In the short term grazing use would be affected by construction on 350 acres, and dry farm production would be affected on 20 acres. In the long term future land use on 610 acres would be affected. Of these 610 acres, 485 acres are grazing land at the proposed treatment plant complex, of which 65 would be occupied by roads, buildings, and other structures and 420 would be used for open space. The remaining 125 acres, in the new right-of-way for Conduit No. 27, would be lost from possible development for primarily residential use in the long term.

During the short term construction period the Foothills Project would use about 28.9 million kilowatt hours of electrical energy. In the long term, however, the hydrogenerator would produce 11 million kilowatt hours annually. The plant and dam operation would use 8.9 million kilowatt hours

annually. Over the life of the project, therefore, there would be a net gain of over 128.6 million kilowatt hours of electrical energy for sale and ultimately human consumption.

Employment of an average of 400 construction workers for 3 years would provide a small socio-economic boost in the area of unemployment. However, over the life of the project only 25 full-time workers would be employed which would not significantly affect socio-economic conditions in the Denver area.

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

This chapter identifies the extent to which the proposed action would irreversibly curtail the range of potential uses of the land and its resources. In this context the term irreversible is defined as use that is incapable of being reversed; once initiated, it would continue. The term irretrievable means irrecoverable; once used, it is not replaceable.

Although the natural productive capacity of impacted land and water resources would be regained in the short term or long term, or after the 75-year project life, interim production would be lost. Those production losses, cited in Chapter VI, would be irretrievable.

If the proposed action were permitted, approximately 105,724 acre-feet of additional water would be transported from the Colorado River Basin to the Missouri River Basin between 1980 and 1995 than would be possible without the project. This earlier commitment of water supplies for municipal and industrial use would allow current life styles and water consumption patterns and trends to continue for 8 years longer, until 1988, than they could without the project. Once set, life styles and water use patterns would be difficult if not impossible to change. The population which would be added to the DWB's service area between 1980 and 1988, nearly 300,000 persons, would certainly increase pressures to develop additional supplies of raw water so established life styles could continue for an extended time.

Construction of the Foothills Project would require 300,000 tons of aggregate, 48,000 tons of cement and 10,000 tons of steel. Except for possibly 5,000 tons of steel which could be practically salvaged, these resources would not be recovered and would be considered irretrievable.

The dam and reservoir in the South Platte Canyon would irreversibly alter the rough, rocky canyon into a flat-water reservoir with an imposing 243-foot-high concrete dam on its downstream side. This 1.7-mile-long body of water would replace the naturally turbulent South Platte River for that distance. The structure would permanently change the 95 acres of stream aquatic and terrestrial habitat into reservoir aquatic habitat with a net loss of 42 tons of biomass annually for as long as the dam would stand. Considering present technology this structure could not be practically removed. These effects, therefore, could not be reversed at any time in the foreseeable future. The dam would unalterably transform the natural continuity of the canyon to one dominated by the presence of a man-made feature. Further, recreational use patterns and trends would be altered and land use options not compatible with its presence would be eliminated.

The construction of the proposed project would cause all known or unknown encountered archeological, historical, and paleontological resources to be preserved only as data, destroyed or removed from context. Although there may be other similar cultural sites and values at other locations, the loss of these particular resources would be considered an irretreivable commitment. Notable among these resources which would be lost are 4.3 miles of Denver and Rio Grande narrow gauge railroad grade, 1.7 miles of DSP&P narrow gauge grade, Deansbury Station and Strontia Springs. In addition, the historic Keystone bridge would be removed for placement at another appropriate site. Also, there would be a good chance that buried Paleo-Indian and/or paleontological resources would be destroyed and lost at the treatment plant complex and along Conduit No. 27. This commitment would be significant.

The 65 acres which would be occupied by permanent structures at the treatment plant would lose their natural productivity for the project life. More importantly, however, would be the land use trend set. Once the 485 acres owned by the DWB in and around the proposed plant were committed, this industrial use would continue. The water treatment facilities would be removed after the project life and probably replaced by others associated with industrial use. This commitment would therefore be irreversible.

In the 125 acres of <u>new</u> right-of-way for Conduit No. 27 would, along with Aurora's existing right-of-way, control future land uses. During the 75-year project life, its presence would result in developmental layout and design in adjoining areas which would accommodate restrictions to permanent structures. These developments would remain long after the life of the project as would their layout and design features. It would be possible for adjoining uses to extend onto the right-of-way after 75 years; however, the adjoining developments would still control layout and design over the conduit. The developmental layouts and design would be irreversible.

Associated with the construction and operation of the proposal would be a commitment of electrical energy. Construction would require about 28.9 million kilowatt hours while 8.9 million kilowatt hours annually, or a total of 667.5 million kilowatt hours, would be used over the 75-year project life. This represents a total commitment of 696.4 million kilowatt hours of electrical energy. However, since those 8.9 million kilowatt hours would not exist without the project, only the 28.9 million kilowatt hours lost to construction would be irretrievable. In summary, there would be a commitment of $89 million worth of goods, services and manpower to the project. This would include 400 workers over the 3-year construction period and 25 workers over the 75-year project life that might otherwise be unemployed.

VIII. ALTERNATIVES TO THE PROPOSED ACTION

Two categories of alternatives were considered: (1) Major alternatives, which included no action, structural and location alternatives, and (2) minor alternatives, which are options to a single component of the project.

The alternatives are described and analyzed under the assumption that appropriate mitigating measures proposed in Chapter IV would be applied to each alternative. Mitigated impacts of each alternative are described to the extent that the option differs from the proposed action. Table VIII-1 compares impacts of the proposed action and the major alternatives.

In addition to the alternatives analyzed, numerous other alternatives were considered but were rejected because they were not technically feasible or they would result in unacceptable environmental impacts.

TABLE VIII-1

COMPARISON OF IMPACTS OF THE PROPOSAL AND MAJOR ALTERNATIVES

Area of Impact	Proposed Action	No Action	Upstream Alternative	Chatfield Alternative
Socio-Economic				
No. of jobs for 3 years	400 jobs	0	300 jobs	250 jobs
Water shortage days in 1985	11 days	31 days	11 days	11 days
Date raw water becomes limiting factor	1988	1995	1988	1988
Electric energy	Produce: 11,000,000 kwh Use: 8,000,000 kwh Surplus: 3,000,000 kwh	0	8,000,000 kwh	30,000,000 kwh
Water				
1988 average annual flow in the South Platte above the Platte intake	290 cfs (2.6 miles)	463 cfs	290 cfs (4.3 miles)	483 cfs
Aquatic habitat				
Miles of stream lost	1.7 miles	No change	0.5 miles	No change
Replaced by acres of reservoir	95 acres	NA	8 acres	NA
Geology, topography, and minerals	Speculative prospecting for iron, copper or uranium would be impossible for 75 years.	No change	No change	No change

TABLE VIII-1 (Cont.)

	Proposed Action	No Action	Upstream Alternative	Chatfield Alternative
Soils				
Sediment yield (additional above present) for project life	1,752.6 tons	No change	1,793 tons	1,175 tons
Terrestrial Habitat				
Vegetation permanently lost	171 acres	No change	75 acres	65 acres
Vegetation temporarily lost (3-5 years)	388 acres	No change	389 acres	313 acres
Type of Bighorn habitat lost during construction	Summer range Winter range Lambing grounds Breeding areas	No change	Summer range	No change
Reduction on Bighorn population	From 80 to 30 head	No change	From 80 to 30 head	No change
Increased feeding area for peregrine falcon	98 acres	No change	8 acres	No change
Eagle eyries disturbed	One eyrie	None	Two eyries	None
Loss of habitat for other species in miles of canyon bottom	4 miles	No change	8 miles	No change
Climate and air quality	Air quality in the construction area will be degraded by dust and vehicle emissions in amounts too small to measure	No change	Same as proposed action	Same as proposed action

TABLE VIII-1 (Cont.)

	Proposed Action	No Action	Upstream Alternative	Chatfield Alternative
Noise				
Intermittent noise levels in construction area	90 dBA	No change	90 dBA	90 dBA
Aesthetics				
Reduced by power lines				
canyon	2.8 miles	No change	1.5 miles	No change
plains	0.4 miles	No change	0.5 miles	5 miles
Reduced by dam	243 feet high	No change	50 feet high	No change
Cultural Values				
Historic features lost	1.7 miles narrow gauge railroad grade (DSP&P; D&RG, Deansbury Sta., Strontia Springs site, Keystone bridge)	No change	1/4 mile narrow gauge railroad grade (DSP&P)	No change
Recreation				
Visitor days lost during construction	15,000	No change	24,000	No change
Land Use				
Land use options lost	727 acres	No change	588 acres	312 acres

Major Alternatives

No Action

Description

Under the no action alternative, the BLM would deny the right-of-way application for construction of the Strontia Springs diversion dam and reservoir, tunnel, and access road improvements.

Analysis

A rejection of the DWB's right-of-way applications would restrict expansions of its raw water diversion facilities in the South Platte Canyon. As a result, the proposed Foothills treatment facilities and treated water conduits would not be constructed.

Without additional capacity, the population in the DWB service area would experience water shortages on 31 peak days by 1980, which would increase to 69 days by 1995 (Table II-26). To cope with the situation, the DWB would probably initiate a water rationing and conservation program similar to that described in Chapter II for the future environment without the proposed action. Since denial of the right-of-way applications would result in the same situation as the future without the project, the environmental impacts of no action would be the same as described in Chapter II for the future without the project.

The no action alternative would result in the occurrence of peak day shortages about 7 years sooner than if the project were constructed. However, by 1995 and in years beyond that date, consumers in the DWB service area would experience an equal number of water shortage days with or without the project.

Chatfield Alternative

Description

As an alternative to the proposed action, a treatment plant and pumping station could be constructed at Chatfield Reservoir, 12 miles downstream from the proposed Strontia Springs Dam. Raw water would be pumped from Lake Chatfield and piped about 7,000 feet to a treatment plant located between West Plum Creek and the South Platte River (Fig. I-3). A raw water conduit 108 inches in diameter would link the intake tower to the treatment plant. The intake tower and pump station would be located southeast of the existing Chatfield Dam intake tower (Fig. I-3). The tower would be 120 feet high (to ensure it being above the flood pool level) and would include trash racks. Pumps would be capable of lifting water from the 5,426-foot elevation at the intake to the 5,530-foot elevation at the treatment plant. Lake Chatfield would have to be drained for about 1 year to allow for construction of the intake structure, pump station, and intake conduits.

The water treatment plant would be similar to the proposed Foothills plant; however, filtration capacity would have to be 10 percent greater because of higher turbidity and algae content. About 200 acres of land would be required for the plant with no buffer. Access would be by existing roads. As opposed to the on-line or base nature of the proposed Foothills plant, the Chatfield facility would be employed as a peaking plant, operated as needed to ensure that demands for water do not exceed base-treatment capabilities at Moffat and Marston. Construction of the Chatfield treatment plant would parallel the schedule proposed for the Foothills plant, but the overall work force would be reduced to about 250 jobs annually for 3 years.

Treated water from the treatment plant would be pumped to the Hillcrest Reservoir via an alternate Conduit No. 27 (Fig. I-3) and the required portion of Conduit No. 27. The alternate 108-inch conduit would follow Roxborough Park Road south to Titan Road and then turn east to intercept the proposed alignment of Conduit No. 27. The total length of Conduit No. 27 would be about 15.5 miles (5,000 feet less than proposed). The design for an alternate Conduit No. 27 would be the same as for the proposal.

To employ the Chatfield Dam and Reservoir in the Denver water system would require that certain arrangements be negotiated with the U.S. Army Corps of Engineers. The present operating criteria for the reservoir would require modification to allow the DWB to operate on a put and take basis within the allowed 4-foot fluctuations in the level of the permanent pool. Such an agreement would probably require congressional approval; however, it does not appear that a relatively minor change in reservoir operation would represent major blocks to implement the Chatfield alternative.

Upstream Dam Alternative

Description

Another alternative to the proposed action would involve construction of a lower dam farther upstream from the Strontia Springs site. A tunnel 8.5 feet in diameter would convey raw water to the proposed treatment plant site. The treatment plant would operate as a base plant and would have the same design as the proposed plant. The diversion dam, located about 10,500 feet upstream from Stevens Gulch and about 200 feet upstream from the City of Aurora's existing water intake for the Rampart Tunnel, would be a concrete gravity flow dam with the entire section acting as an uncontrolled overflow spillway. At an elevation of 6,030 feet, the dam crest would be 50 feet above the stream bed with a crest length of approximately 200 feet.

The intake for the tunnel would be an integral part of the dam structure, located approximately at the 6,030-foot level. It would have a simple gated inlet equipped with a trash rack. Sluice gates would be installed in the center of the dam.

At the crest elevation of 6,030 feet, the reservoir would extend about 2,500 feet upstream from the dam, inundate approximately 8 acres of land, and contain 97 acre-feet of water. The reservoir would have little sediment-settling capabilities as water turnover would be rapid. Every 2 years, accumulated sediments would have to be removed by dredging to maintain the diversion facility. These sediments, with a sedimentation efficiency of 10 percent, would amount to about 7,000 tons annually or 14,000 tons each 2 years. These sediments would be used in the Kassler filter plant or disposed of in the impervious fill borrow pit near Kassler and other abandoned ground pits north of Kassler.

All vegetation below the 6,030-foot elevation would be chipped, removed and scattered over disturbed areas above the high-water line of the reservoir. About 8 acres of brush with a few scattered Douglas fir trees would need to be cleared.

Construction of the dam would require about 15,000 cubic yards of concrete and 125 tons of steel. Concrete would probably be hauled in from a staging area at South Platte to a 2-acre staging area that would be located in the canyon near the damsite.

The west portal of the tunnel would be located just upstream from the right abutment of the dam, while the east portal would remain in the same location as it is for the proposed project. No other portals would be necessary. Tunnel alignment would follow a nearly straight line between the two portals. Tunnel length would be approximately 26,500 feet. With a pay line of 10.5 feet in diameter to blasted rock and a finished inside diameter of 8.5 feet, the concrete-lined pressure tunnel would have a capacity of about 1,100 cubic feet per second (710 mgd). Construction of the tunnel would proceed simultaneously from both portals. Approximately 38,500 cubic yards of tunnel muck would be taken from each portal. Muck from the west portal, together with about 23,000 cubic yards of material excavated from the dam foundation, would be deposited on DWB property along a sand bar near the confluence of the South Platte and its North Fork. Approximately 7 acres would be covered to a depth of about 3 feet. Site reclamation and runoff preventatives would include providing cutoff trenches to prevent drainage, replacing topsoil and revegetating. Muck removed from the east portal would be deposited at the site selected for the proposed project tunnel.

Operation of the treatment plant would produce about 17,800 pounds of sludge per day. Sludge drying ponds would be cleaned three to four times annually. During the life of the project about 15 acres in the disposal area would be filled and leveled.

Primary access to the damsite would be from Sedalia through Nighthawk, approaching the dam from the southwest. Although this route has a steep grade at Nighthawk, it would be improved to accommodate construction traffic. About 5 miles would require substantial improvement and realignment and affect about 30 acres. From the town of South Platte to the dam, the road would be improved to a width of 14 feet with turnouts.

A second access route would be from Kassler through the South Platte Canyon. Although this route is shorter, the road would require some improvement in order to upgrade it to a 14-foot road with turnouts. Public access would not be permitted along this route until after the construction period.

A 13.2-kilovolt aerial power line (1.2 miles) would be constructed from South Platte to provide power required for construction of the dam and west tunnel portal. This permanent power line would provide power needed at the dam for operational purposes.

Construction time and manpower for the alternate tunnel would be about 60 percent greater than that required for the proposed project tunnel. Construction of the dam would require about 1 year. The overall construction schedule for the project would not change. Overall this alternative would employ an average of 300 persons for about 3 years.

Analysis

Social and economic impacts similar to those described for the Chatfield alternative would occur if this alternative were pursued. There would be

GPO 833-023